// The Model Engineer

A Journal of Small Power Engineering.

Edited by Percival Marshall, C.I.Mech.E.

VOL. XLVIII. No. 1,145. APRIL 5, 1923. PUBLISHED WEEKLY.

Our Point of View.

The "M E" Workshop.

Some of our **readers** may have gathered from announcements, which have recently appeared in our pages, that the *M.E.* Instruction Workshop is resuming its activities, after a brief period of partial suspension for the purpose of re-organisation of the equipment. During the past few months we have introduced several items of new and up-to-date plant, which will not only considerably improve our tuition facilities, but will give our pupils the advantage of working with more modern and more varied tools. We have now a fine range of lathes, milling attachments, planing, shaping, and drilling machines, forge, and, of course, bench and small tools in great variety. Some of the machines are electrically driven, others are arranged for foot or hand power, so that the pupil can work exactly as he would in his own home workshop. The services of two excellent instructors are available, and any kind of light mechanical or 'electrical work, tool making or model making can be taught. Pupils may come for single lessons or for a series at their own discretion, and may select their own hours and their own subjects. They are not tied down to any hard-and-fast course or routine,. and in this way rapid progress can be made. We are specially well-equipped for teaching screw-cutting in the lathe, and quite a large number of both amateur and professional mechanics have availed themselves of the very practical instruction which is given in this subject. We are always glad to show any visitors round the Workshop, and shall be happy to send an illustrated leaflet giving all particulars as to fees to anyone who may be interested. We do not undertake to do any mechanical or electrical jobs ourselves ; we only give tuition. We have often been asked to make or repair things in our Workshop, but we think it right to leave this to the legitimate trade firms who advertise for such work in our columns.

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The 9.2 Gun Handbook.

Mr. Norman Robinson's 9.2 B.L. gun model exhibited at the last MODEL ENGINEER Exhibition, and there won the " Admiral Bacon Cup," has tempted quite a number of modellers to attempt a similar piece of work and many inquiries have reached us as to where the 9.2 Handbook, to which he refers in nis article in February 8 issue last, can be had. Mr. Robinson has already replied personally to some of these inquiries, and we now reproduce a recent note from him on the subject, which will be helpful to other prospective builders. He writes: " Since the appearance of my short note re my model 9.2-in. gun in the issue of the *M.E.* for February 8, I have been informed from several sources that the " Handbook of 9.2-in. B.L. Guns, Land Service," is no longer to be had. So I hope this note will save any reader who is trying to procure this book further trouble or expense. I procured my copy in 1915 (while living in Italy), from Messrs. Wyman's, at the price of 1s., and as far as I know, up till that date books on all the land service ordnance could be had from the above firm at the same modest price. Now it seems, if my inform&ion is correct, they have been stopped. I wish to take this chance of tendering my most sincere thanks to Mr. Copeland for the kind things he has to say about

my little gun at the foot of his article in the M.E., and I hope that although tardy they will be none the less acceptable. I can assure Mr. Copeland that his praise of my "first offence" in gun building is very valuable to me, as it comes from an expert in the craft.

* * *

Electric Horology.

At a Council Meeting of the British Horological Institution Mr. F. Hope-Jones, M.I.E.E., Vice-Chairman of that body and Chairman of the Radio Society of Great Britain, was asked to give a lecture at tht Institute, Northampton Square, Clerkenwell, E.C.1, on Thursday evening, April 19, at 7.45 p.m. We understand that its title will be "The Free Pendulum," and that the lecturer will deal with the attempts that have been made to free the pendulum from all interference excepting only that resulting from receiving its impulse. These date from the beginning of the century and have culminated in a supreme achievement of accuracy of time measurement at the Edinburgh Observatory, under Professor R. A. Sampson, the Royal Astronomer of Scotland, by means of a free pendulum, designed by Mr. W. H. Shortt, a director of the Synchronome Company. The lecture will be illustrated by drawings and working models. No doubt a good number of our readers will like to avail themselves of this opportunity of spending what will certainly be an instructive and entertaining evening, and if so they should write to the Secretary of The British Horological Institution, at the Institute, Northampton Square, Clerkenwell, E.C.1, for a ticket of admission.

* * *

Model Work Up North.

The newly-formed Edinburgh and District S.M.E. is making good headway we hear. The headquarters are at 59, Rose Street, Edinburgh, at which address the Society will carry on until further notice. The membership roll stands at 51; the Lord Provost of Edinburgh has consented to act as President, and several other well-known figures in the engineering world up North are helping things along in the capacity of Vice-Presidents. A raised track, standing 3 ft. from the floor, is now being laid to accommodate gauges 0, 1, 2 and 3, benches and tools for the use of members are being installed, and a library has been set going. Meetings are held periodically, and at the last one Mr. A. E. Walker gave a lantern lecture on "Models and Model Making," a-hen *Mr. G.* B. Aldridge, J.P., a Vice-President of the Society, took the chair. There should be enough of human material in and around this city to make an exceptionally keen and flourishing Society, and we have no doubt it will be able to continue to report as satisfactory progress in the future as its short young life has achieved in the past.

Livery for the New Railway Groups.

Keen railwayists are speculating on what uniform will be adopted for the locomotives and rolling stock of the new groups. We would suggest that an effor: should be made to have a distinctive colour scheme for each group, so that the man in the street should be able to recognise at a glance to what company an engine or *coach* belongs. There should be no difficulty in arranging this when only four groups instead of a matter of 20 big companies and many little ones are concerned.

Here are our suggestions for the groups :—

For the London, Midland and Scottish locomotives. *Passenger* : Midland red, brass beading, lined out in yellow and black. *Goods* : black, with white and red lining (present North Western standard). *Coaching stock* : Midland red with North Western white upper panels. *Goods stock* : Midland red.

London and North Eastern locomotives Passenger: Old Great Eastern blue. *Goods:* Old *Great Northern green. Coaching stock:* blue to match engines. with white upper panels. *Goods stock*: blue.

The Southern Railway locomotives. *Passenger*: present South Western laurel green with black and white lining as now. *Goods* : Dark olive green with yellow lining (present South Western). *Coaching stork* : laurel green with white or cream upper panels. *Goods stock*: Dark green.

Great Western locomotives. *Passenger*: Chocolate lined with gold. *Goods* : Old Great Western green with red under-frames. *Coaching* stock : As now (chocolate with cream upper panel). *Goods stock* : chocolate.

In compiling the above we have tried to keep to British tradition, implying as it does smart engines and coaches and also the individual tradition of the companies, yet all so distinctive that in the new days of competition, which we are told are coming, there shall be no difficulty in picking out rivals. A good livery is necessary as an advertisement Even the Post Office believes in its red livery!

C. A. H. (Clapham).-The cell you refer to is apparently one of the Edison Lalande type. Enquire of The General Electric Co., Magnet House, Kingsway, London, W.C These are good cells for lighting purposes, but owing to the low voltage a larger number would be required than cells of the bichromate type. Our book "Electric Batteries," price 10½d., post free, will give you information. A lamp of about 10 volts 8 candle-power, would probably suit your purpose.

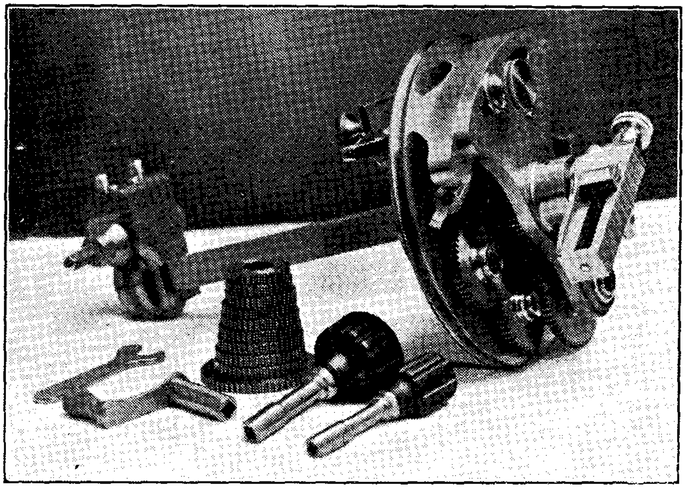
Ornamental Lathes and Old Times.'

By J. T. A.

THE recent article on ornamental lathes in THE MODEL ENGINEER, by my old friend Mr. F. Westmoreland, would, I am sure, be appreciated by very many readers. But to no one could it be of more interest than to myself, for I am a member—though an obscure one-of that little band of all-round mechanics of which Mr. Westmoreland writes so lucidly, and of which he is himself such a shining example.

I also was apprenticed with the late Mr. H. B. Massey, and can confirm what Mr. Westmoreland has said about the variety and quality of the work turned out. I had been there some nine or ten years when Mr. Westmoseland arrived on the scene, and had charge of a great deal of the work. Thus he was, to all intents and purposes, my pupil; a faot of which I am not a little proud. There Mr. Westmoreland had the opportunity to become a first-class craftsman, and he made the very best of it. But I think I am right in saying it n-as that after-experience, gained in large works, in the erecting and testing of prime movers, and in other capacities, which developed those powers that have made him eminent in the model-engineering world.

Did space permit, I could write a great deal about the characteristics of my apprentice-contemporaries and others connected with the works, with some of whom I have kept in correspondence to this day. But I must just make a passing reference to the "old man." "Billy," who was quite a noted character, has long since gone to his rest. When a lad he turned his back on his native fens and found employment with one of the Lincoln firms, to whom apparently he became of value; for, as he said, the firm offered him a good post at "Vianna," which love of his own country, however, prevented him from accepting. He had unbounded confidence in his own ability, and was equally at home at the forge, the lathe, the pattern bench, or in fixing up a steam-boiler, running a steamboat, or making his own trousers. It is scarcely necessary to say that he was one to whom the micrometer did not appeal. I have vivid recollections of a rather startling incident which occurred when Billy was brass-casting. I may remind Mr. Westmot-eland that we had at one time a brass furnace of the regulation type. Billy picked up mhat he thought was a bucket of coke and threw the contents on to the fire. But it happened to be water! The vile stench which ensued may be left to the imagination.



An Epicycloidal Cutter.

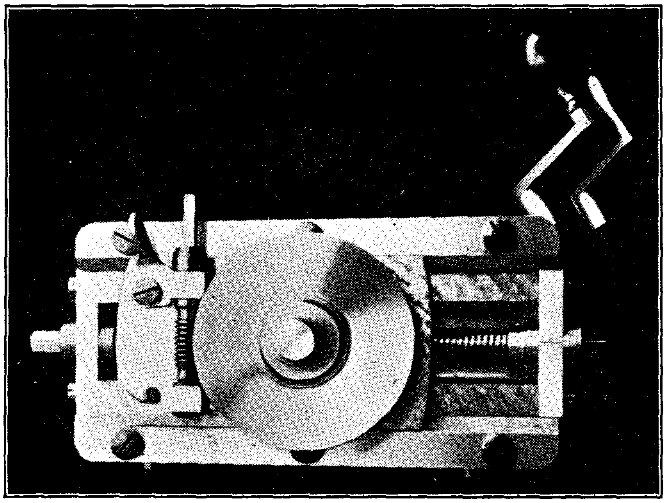
For books and book learning Billy cared not at all. That

"ample page,
Rich with the spoils of time,"

was to him as nothing. His own philosophy was sufficient for him. Mr. Massey n-as once talkng to him about astronomy. "Ah. master," he said, "some dav I shall get to know more about them things in twenty minutes than you will by studying them all your life."

On another occasion someone repeated the well-known saying about the certainty of death "No," said Billy, "*you are not certain of that.*" And I think he was right

With regard to the late Mr. Massey, I feel sure, indeed I know, that among the readers of the *M.E.* there are some who would like to have his memory kept green. As I was for many years intimately associated with Mr. Massey in his work, and also in his pleasures and recreations, I may perhaps be competent to undertake a very brief sketch of his character and achievements.



The Rectilinear Chuck.

Although reserved by nature, Mr Massey was a man of wide culture, and in the company of those with whom he found tastes in common he was really a brilliant conversationalist and a most entertaining companion. He took a keen interest in astronomy, and became a F.R.A.S. Mr. Massey was an all-round sportsman, but it was perhaps as a figure-skater that he was most noted locally. He travelled on the Continent rather extensively, and there was scarcely a corner of England which he had not visited.

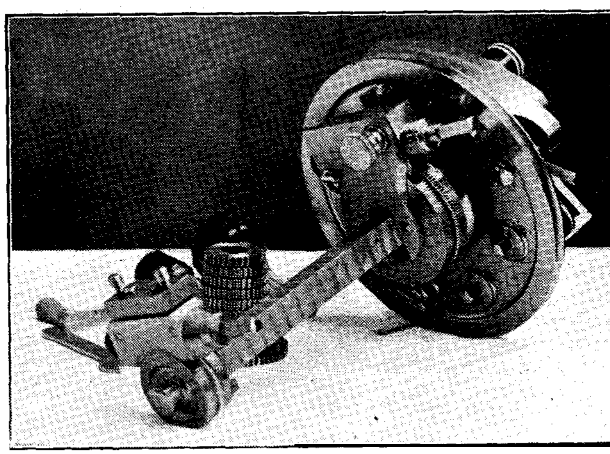
In the year 1893 a very serious misfortune overtook Mr. Massey. A fire occurred one Saturday afternoon, and by evening the whole of his fine plant and hundreds of costly tools were ruined and buried feet deep in the debris. It was a grievous loss as the insurance had lapsed, but Mr Massey bore it with fortitude, and immediately began to clear up the wreck. He again built up a plant, and for some years longer did a considerable business; indeed, I think his best work was turned out after the fire. At any rate, the ornamental lathes and apparatus described by Mr. Westmoreland were made at that time. But I gathered, from conversation with Mr. Massey, that, had he foreseen that his efforts would have met with so small a reward he would not have undertaken the task.

The indomitable spirit of the man is shown by his having got me to make for him a self-propelled bathchair, in which, bearing upon him the mark of physical disorder—knowing that he was doomed, yet imbued with that spirit which meets death with equanimity—he daily went about his business.

Mr. Massey, like most of us, was not without imperfections and eccentricities. But those of us who followed him to his last resting-place experienced only one feeling-the feeling that we had lost something which could not be replaced ; and time has not effaced that feeling.

I have in my possession the lathe which Mr. Massey had under construction shortly before his death. It is similar to Fig. 1 in Mr. Westmoreland's article, but has traversing mandrel. It has done very little ornamental work, but it has proved to be a very useful tool for fine and special work in the engineer's shop.

When in 1898 I commenced business on my own account I resolved to maintain the high standard of workmanship to which I had been brought up, and, at the same time, to pay attention to up-to-date methods and tools. As a matter of course, my shop became a training ground for apprentices, many of whom have done well. We did a great variety of work. Quite a number of our lathes went to technical schools in the Dominions. In addition to



Another View of Epicycloidal Cutter.

machine-tool making, there was the general run of local engineering work, and the making of motor parts. We also designed and made numerous special machines for various purposes. Of ornamentai turning apparatus for some years we made a considerable amount, including ‘rectilinear, oval, eccentric, and dome chucks, spherical and ordinary slide-rests, besides many other things which I cannot call to mind just now. The illustrations will give an idea of the class of work. To make an epicycloidal cutter without having seen one is a rather formidable job, as anyone trying it will find. I am referring not so much to the high grade of workmanship required, but to the amount of preliminary work and study which such a job entails. In this matter I was assisted by the late Rev. C. C. Ellison and other experts. Nearly sixty special tools, jigs, mandrels, taps, broaches, etc., were made in order to produce this one iastrument. The matter of making small multiple-thread screws and taps (also referred to by Mr. Westmoreland) is dealt with in my book " General Work in the Small Shop."

All this, however, is, with me, a thing of the past. I recollect that the late Mr. Massey once said. in effect, that there was no fortune to be made by following in his footsteps. And I fear that to-day high craftsmanship is still more at a discount. Those who want to " get on " must cultivate brains rather than hand skill. Of course, I do not mean that all-round mechanical ability is not a’ great asset. But when a manufacturer comes and asks one to design and make a special machine, he does not enter into all that, nor does he care about what the machine is going to be like-he doesn’t want an ornament. What he says is : " Can you make a machine that will do twice as much work as this one does, and keep on doing it? " The reward for the use of brains, however, is none too great. The engineer cannot afford to bring out a failure, his reputation is at stake. He sows; others reap. My experience shows that the people who " get on ' are those n-ho possess the kind of brain which enables them to pick the brains of others. But I had better not enlarge an this subject. The engineer, whether professional or amateur, who takes an interest in his work finds that it has, like virtue, its own reward. There is this to be said : an all-round experience, such as the " old shop " could, and did, afford, is a very good foundation for a young man to build on. The ability to start with a sheet of paper, work the thing out, and, if necessary, to carry the whole job through single-handed, is almost certain to be advantageous to him at some time or’other. whatever may be his ultimate aims and achievements.

A Design for a Model Compound Condensing Steam Engine-V.

By " Axle. "

(Continued from page 327.)

The valve box of the circulating pump is shown in Fig. 44. It has a vertical partition, which separates the delivery valves from the suction valves. The inlet flange is on the bottom and the delivery is on the side of the valve box. The casting should be machined at the joints, which register with the body and cover. The seats for the. delivery valves can be faced with a $\frac{3}{4}$-in. diameter centre drill. Each seat has six $\frac{1}{8}$-in. holes drilled in it, and the centre drilled and

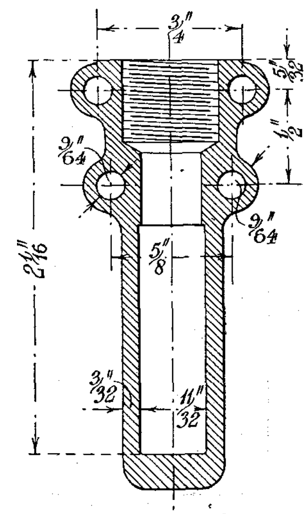


Fig. 46. Feed Pump Body, G.M.

Section of Feed Pump Body.

tapped So. 5 B.A., into which is screwed the valve guards. The valve guards are turned from bar, one end being a countersunk head with a screwdriver slot, and the other screwed to take a No. 5 B.A. nut. The valves may be made either of leather or rubber. They are 11-16th in. diameter and about 3-32nd in. thick, and have a 3-16th-in. hole cut in the centre. The valve box is drilled to suit the studs on the body. and the centre partition *is* drilled and tapped No. 5 B.A. at the centre, thus making provision for an extra stud for securing the valve box cover.

The inlet and outlet flanges are drilled 5-16th in. and are provided with two **No.** 5 B.A. studs in each for securing the cooling water pipes. The top of the valve box is drilled and tapped to suit the air vessel (Fig. 45). The cover is made-

from a casting and has nine 9-64th-in. holes drilled in it. It should be faced on both sides and the edges filed up to size.

The air vessel is made from gun-metal bar. A piece of bar is drilled $\frac{1}{2}$ in. down the centre to a suitable depth and counter-drilled 3-16th in. One end is screwed to suit the valve box. A turned cap is either screwed or silver-soldered into the top, after which the complete vessel can be turned and polished smooth on the outside.

The feed and bilge pumps are shown in Figs. 46 and 47. They are of the same dimensions, except that the bosses for the fixing studs are higher on the feed pump than on the bilge pump. The bilge pump is attached to the side of the circulating pump and the feed pump is attached to the side of the hotwell. A casting will be required for the pump body. It should first be machined across the faces of the bosses, and then attached to an angle plate fixed to the faceplate and a 5-16th in. diameter drill put down the centre. The lower portion can then be opened out with a hooked tool to 11-32nd in. diameter to form a clearance for the plunger. The stuffing box is screwed with a fine thread $\frac{1}{2}$ in. diameter and the end of pump faced. The boss at the bottom of the pump is drilled and tapped $\frac{1}{8}$-in. gas. The plungers are made of gun-metal and should be turned up smooth and parallel. The top end is turned to a push fit into the pump crosshead and screwed to take a 5-32nd-in. nut.

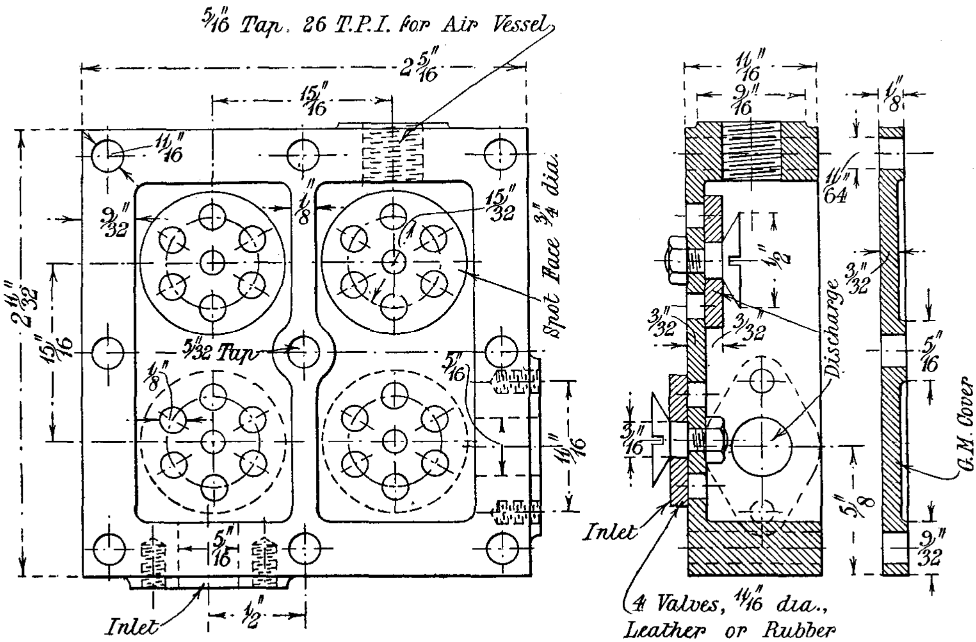


Fig. 44. Valve *Chamber of Circulating Pump*

Elevation **and Section of Circulating Pump Valve Box.**

All the pump rods are shown in Fig. 48. The circulating pump rod and bucket forms one piece. The piston is turned to a good sliding fit into the circulating pump body. It has two grooves turned on the outside. The guide rod is made of mild steel, and is turned to a sliding fit into the pump guide bracket. Fig. 49 shows the air pump bucket or piston. It is made from a casting and is turned on the outside to a sliding fit into the air pump barrel. It should be machined all over. The seat is drilled with eight 13-64th-in. diameter holes. The air pump foot valve, Fig. 50, is also made from a casting and is turned up all over in the lathe. The upper side is recessed to suit the spigot on the air pump barrel, and the portion under the flange is turned to a push fit into the bedplate. The seat has eight 13-64th-in. holes drilled in it and the flange is drilled to suit the studs in the bedplate.

The valve guards, Fig. 51, are turned from bar. The head valve guard is turned to a push fit into the air pump cover and forms the bottom of the stuffing box. There are six $\frac{1}{8}$-in. holes drilled in the flange of the head valve guard and four $\frac{1}{8}$-in. holes in the bucket valve guard.

The air pump cover shown in Fig. 52 is made of gun-metal. It is bored out to suit the gland, which is identical with the gland fitted to the

circulating pump cover. The spigot under the flange is turned to a push fit into the hotwell casting. The cover is turned all over. The flange should be drilled with six 9-64th-in. diameter holes to suit the studs in the hotwell.

The top is drilled and tapped for the two gland adjusting studs.

The valves boxes for the feed and bilge pumps, Fig. 53, are machined from gun-metal castings. The ports are drilled out 3-16th in. diameter. All the threaded portions are 1/8-in. gas. The valves are steel balls 15-64th in. diameter. The spigot

3/8 in. diameter and the ends faced, the caps being soldered in position for this purpose. The lower portion should be drilled and tapped for the screws securing the caps. The feet are drilled 9-64th in. diameter. The rear of the casting is drilled and tapped for the bolts and screws holding the guide bracket. The rear face should be filed up perfectly square to the base. The caps are provided with lubricating cups, which are drilled 1-16th in. and countersunk with a 90° drill. The caps should be pin-drilled to suit the heads of the screws.

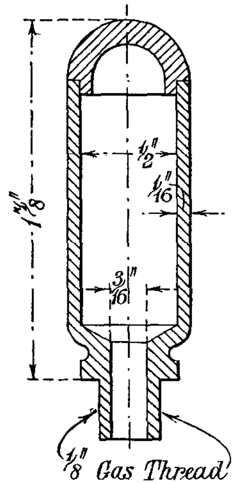


Fig. 45. Air Vessel, G.M.

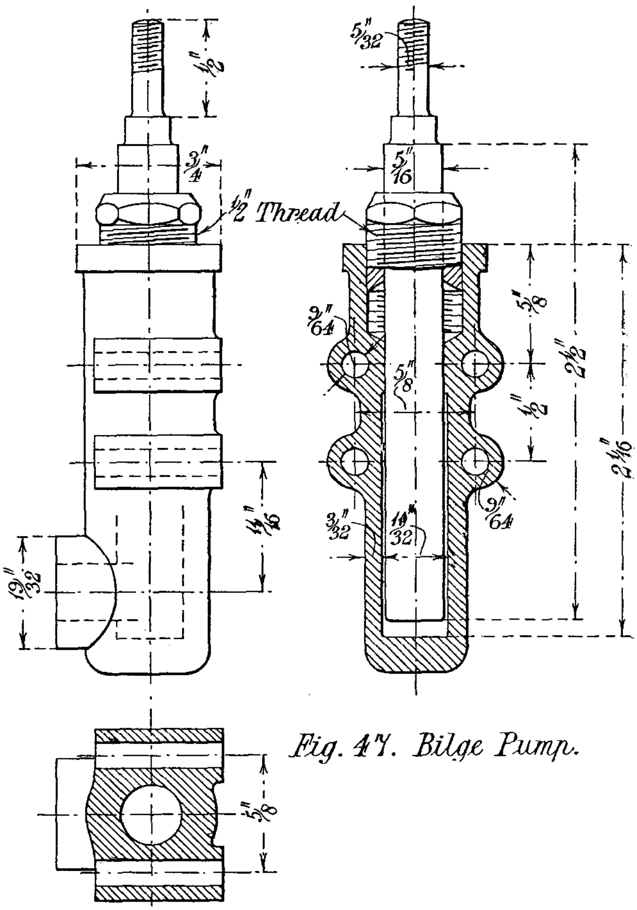


Fig. 47. Bilge Pump.

Section of Air Vessel and Views of the Bilge Pump.

on the plugs should allow the balls to lift not more than 3-64th in. The suction and delivery ends are chamfered to suit the nipples on the pipes. The valve box should be screwed into the pump body and should stand vertical when tightened up in position. Instead of the plug over the delivery valve, an air vessel, similar to the one fitted to the circulating pump, may be fitted to the valve boxes if desired. The bearings for the pump levers shown in Fig. 54 are made of gun-metal. The base should first be shaped flat. The casting can then be bored out

The pump levers are made of steel, Fig. 55. The side plates should be cut from steel plate 1/8 in. thick. The two pieces should be clamped together and drilled 9-32nd in. diameter at the ends for the gudgeon pins, and 5-16th in. in the centre for the fulcrum shaft. The levers can then be bolted together with fit bolts and filed up to size. The gudgeon pins are turned from bar and should be tight fit into the levers, the ends being left long enough for riveting over. The holes in the levers should be slightly countersunk on the riveted side, for riveting. The centre shaft is

turned from bar. It has two flanges turned on it to which are attached the side plates. In assembling the parts care should be taken to get the axis of the centre shaft in the same plane as the axes of the gudgeons. The flanges of the above the marking off table. The other side plate should be tapped on set parallel to the marking off table. The scribing block should now be applied to the centre of each gudgeon, and, having adjusted them all to the same height, the

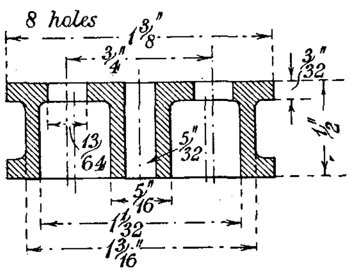


Fig. 49. Air Pump Bucket

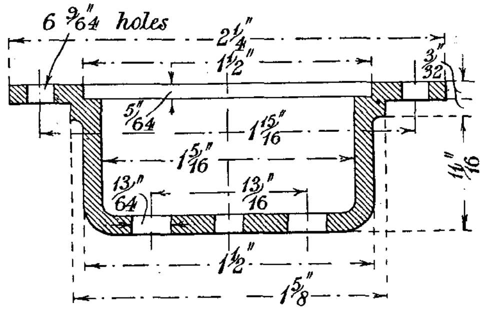


Fig. 50 Air Pump Foot Valve

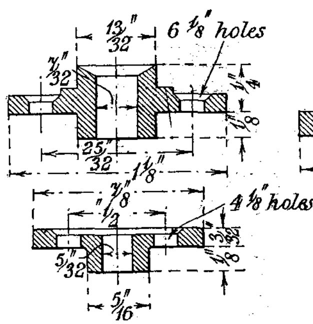


Fig. 51. H.V. Guard. G.M. & F.V. Guard.

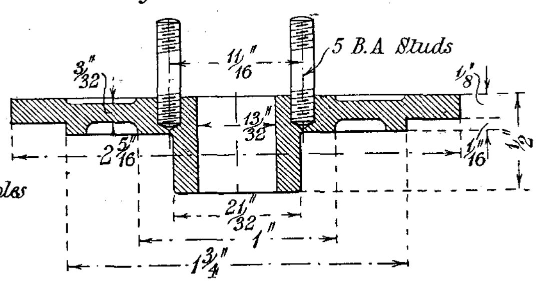


Fig. 52. Air Pump Cover

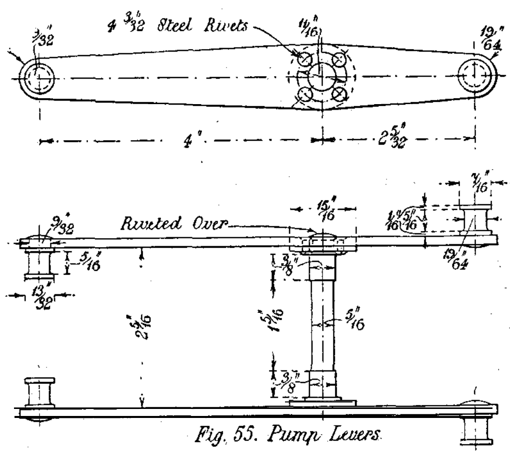


Fig. 55. Pump Levers.

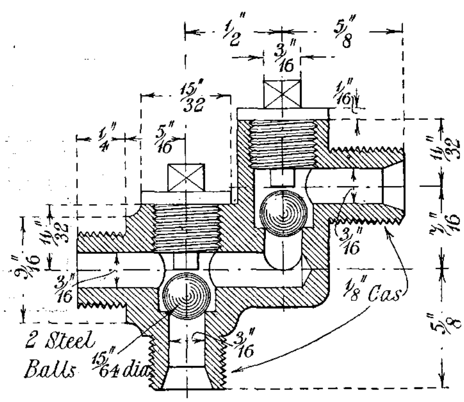


Fig. 53. Feed Pump Valve Box, G.M.

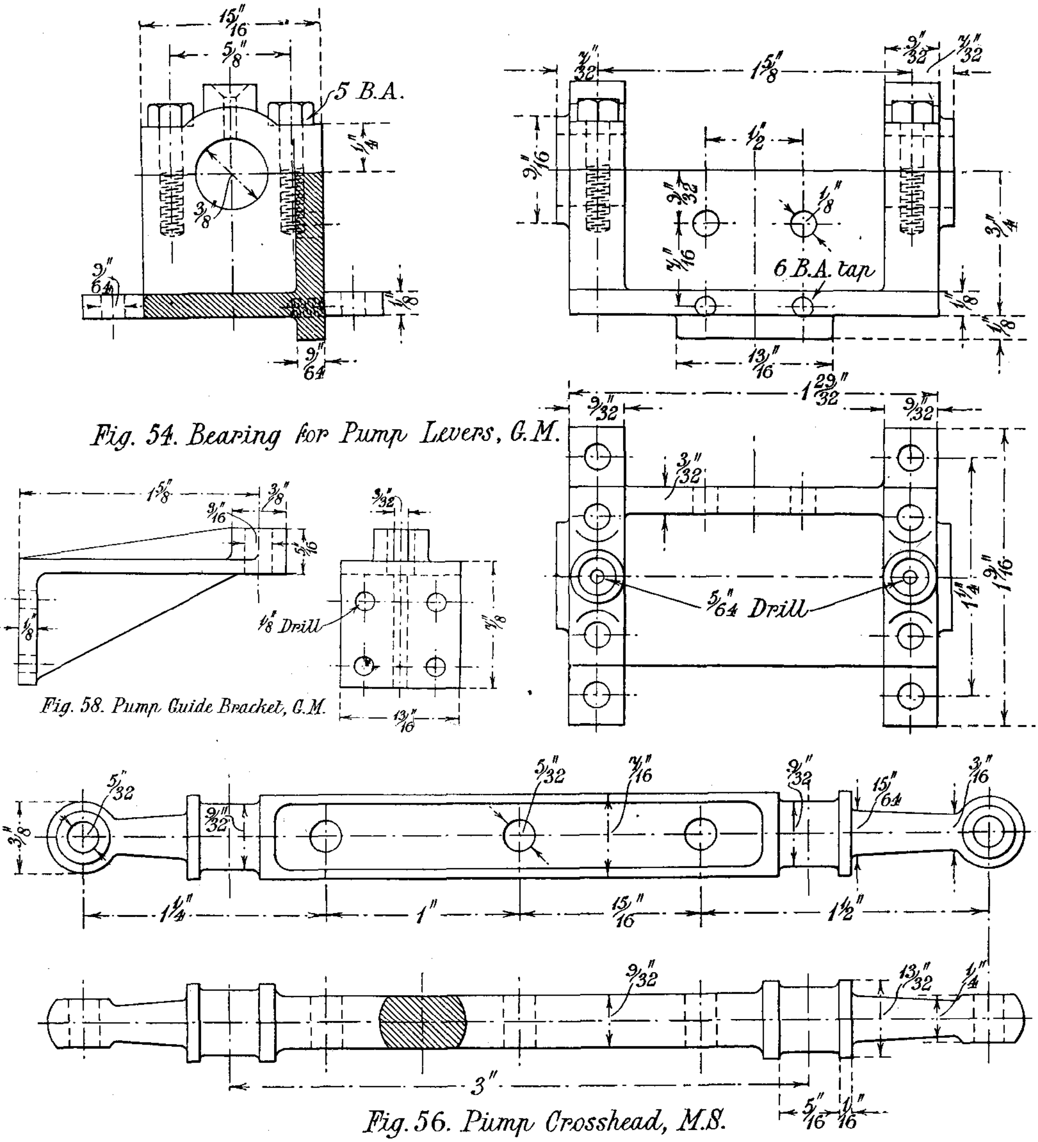
Details of Air Pump Components and Section-et Feed Pump Valve Box.

centre shaft should first be drilled for the rivets and one side plate marked off from it, drilled, and riveted on. The shaft and side plate should now be placed in two vee-blocks and the centres of the gudgeons adjusted to the same height rivet holes can be marked off on the loose side plate for drilling. After drilling the plate Should be placed in position again and four pegs light driven into the rivet holes. The levers should be tested again for alignment, and, if correct,

the plate can be riveted up. If the plate should require a little adjustment then the rivet holes can be reamered out to suit.

Fig. 56 shows the crosshead for the pumps. It is made from mild steel bar. The ends are first turned spherical, then drilled, and faced. The

The links shown in Fig. 57 connect the levers to the piston rod at one end, and to the crosshead at the other ends. The bearings of the links are made of gun-metal and are connected together with a pair of collar bolts. The bearings should be bored out and faced to suit the



Details of Pump Lever Bearing and Brackets and Pump Crosshead.

centre portion is turned to 7-16th in. diameter and the fats are filed or planed on. It should be turned bright all over. Five 5-32nd-in. holes are drilled in the crosshead to suit the pump rod centres, care being taken to get the holes parallel to each other.

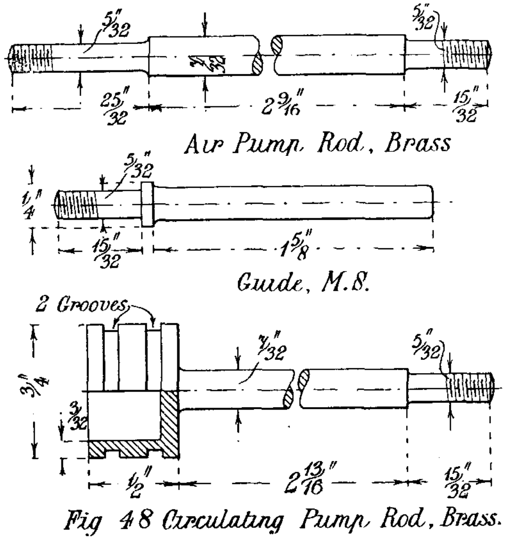
gudgeons. It will be noticed that the front links differ from the rear links in bore and length.

The crosshead guide bracket shown in Fig. 58 is made from a gun-metal casting. The foot should first be machined and then the hole should be bored out parallel to the foot. The foot

should be marked off and drilled to suit the holes in the bearing of the pump levers.

Having briefly touched upon the making of the several parts of the engine, with the exception of the pipes, lagging, etc., we will deal with the assembling of the parts.

The bedplate should be bolted to a level rigid foundation. Two pieces of square bar would make a suitable seating. The bottom halves of the main bearings should then be fitted into the pockets and the crankshaft put into place. Each



Air and Circulating Pump Rods and Guide Bar.

top half main bearing should be fitted separately and tried for clearance when tightly screwed up. The shaft should be free to rotate, without shake, in all the bearings. The condenser should now be bolted in position with the guide faces parallel to the axis of the shaft. The front columns should then be erected and tested to see if they are all of the same height by laying a straight edge across the top of the flanges.

The top of the condenser columns and the tops of the front columns should all lie in the same plane.

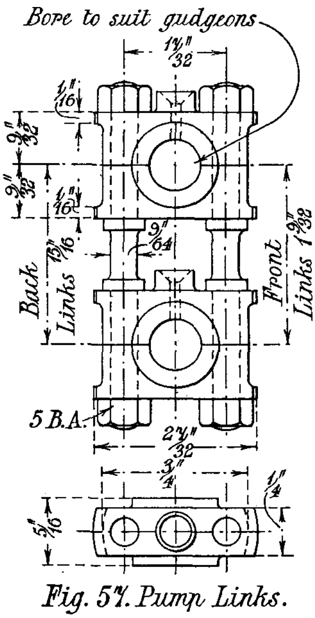
The cylinders can now be placed on the columns for *marking off* the holes in the feet. The position of the cylinders should be adjusted to get the centre line passing through the centres of the cylinders parallel to the axis of the shaft, and the vertical centre line of the cylinders passing through the centre of the shaft.

A gauge of thin sheet steel made to register with the main bearing pockets, face of rear columns, and the central hole in the bottom of the cylinder would be useful in aligning the cylinders.

After marking off the holes in the feet the cylinder should be drilled and bolted up in position.

The pistons and piston rods can now be fitted and the back of the slipper eased if necessary to obtain a smooth working fit on the guide plate. Any further adjustment of the guides due to wear can be made by inserting thin liners behind the guide plate. The connecting rods should be fitted up next. They should be free owing to swing in the top end bearings when tightened up, and they should be free to rotate about the crankpin when the bottom ends are tightened up. It is perhaps superfluous to mention that neither the crankpin nor the gudgeon-pin should be eased to obtain the correct working fit, and all adjustment should be made on the gun-metal bearings.

The valve gear can now be erected. The brackets should be placed on the reversing shaft and the shaft clamped up into position for marking off the holes in the brackets, which after being drilled and tapped can be bolted to the columns. The eccentric straps should be adjusted to their respective sheaves. The valve spindles should be fitted with the L.P. steam-chest, H.P. steam-chest covers, and guide brackets temporarily placed in position. The guide brackets can then be marked off, drilled,



Elevation and Plan of Pump Links.

and permanently fitted up: The radius links, link blocks, and drag links can now be assembled.

The worm wheel and reversing shaft should be fixed on the weigh shaft, and after connecting up the drag links to determine the exact position of the reversing levers they should be drilled and pinned to the weigh shaft.

(To be concluded.)

Springing Model Passenger-Carrying Vehicles.

By Henry Greenly, A.I.Loco.E.

MANY readers have no doubt found that if a model wagon, or other vehicle on which juvenile (and adult) passengers may from time to time ride, is sprung in such a way that when it is empty its axleboxes respond to the inequnlitics of the track--when the passenger sits on it, the springs are compressed beyond their safe limit of deflection, and the truck to all intents and purposes becomes an unsprung vehicle. This may not he considered important in the case of a truck which is used only on a testing track at a Society meeting or Exhibition, but where a comfortable ride is desirable and where it is important that such shall be free of any possibility of a derailment when the vehicle is unloaded, some device that will ensure an equal vertical flexibility under both tare and loaded conditions is necessary.

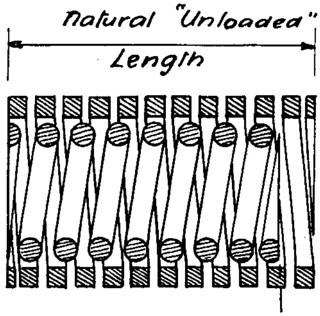


Fig. 1.—Relative Sizes of Two Springs before Fitting in Place.

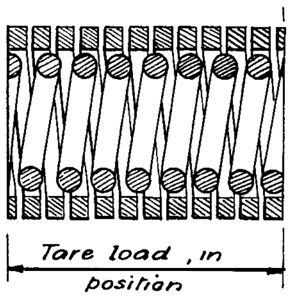


Fig. 2.—Main and Auxiliary Springs Under Tare Load only. Smaller Spring taking no Load unless Vibrations occur.

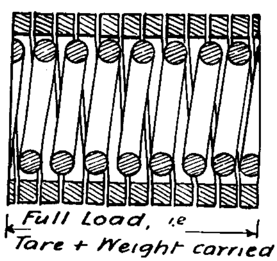


Fig. 3.-springs Fully Loaded, both taking a Share of Weight according to Pre-determined Design.

The writer had considered this in 1910, when getting out drawings for some miniature-railway coaches, and designed what he thought was a suitable spring gear. The arrangement comprised three spiral springs per axlebox, but the contracting firm, not appreciating the scheme, produced a similar axlebox guide nith a socket for one spring only. These have been in use since before the War, but that calamity prevented the writer thoroughly testing these single-spring boxes until Mr. R.P. Mitchell, the general manager of the Eskdale line, gave the writer a free hand to experiment with a coach. This vehicle was one of several which were noted for " dancing " on their springs when running empty, and, if loaded nith over four persons (eight represents their seating capacity), humping badly at rail joints, points, and other imperfections in the surface of the road. Investigations in the works stores showed that the coach springs varied, one batch being weaker than the other, due to a slight enlargement in outside diameter. Calculation showed—the writer always uses Mr. Wilson Hartnell's values for safe load and deflection-- that while all the springs

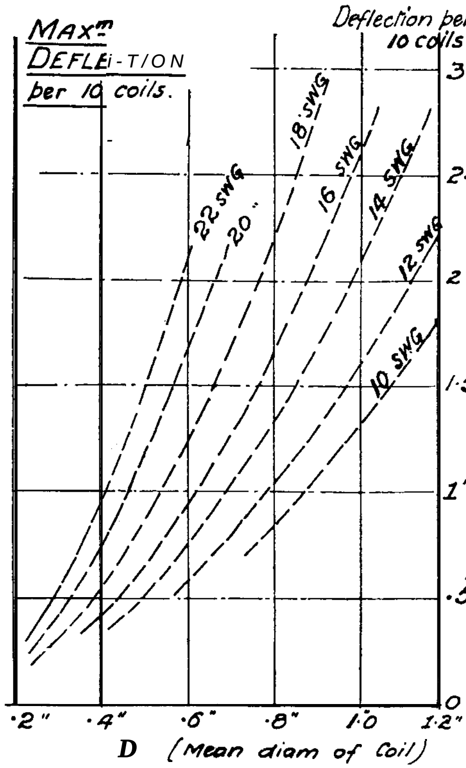


Fig. 4.-Spiral Spring Deflection Curves.

were strong enough--i.e., were within the limits of safe stress-they were weak in deflection, the figures also showed that they would close with a load of five persons plus the tare weight of the coach.

To get over the trouble and to revert to the original scheme without involving structural alterations, a set of four auxiliary springs were designed, which would loosely fit inside the existing weak springs. Unloaded, the springs would lie as shown in sketch, Fig. 1, but in the coach running without passengers the new inner springs were arranged to just come into action when outer main springs are compressed by the tare load of the vehicle. When fully loaded the two springs support the load (Fig. 3) on each of the individual axleboxes; the main springs taking the tare weight, 288 lbs. per wheel* plus four or five passenger load-say, 180 lbs. per wheel-the auxiliary ones the remaining 120 lbs. A fourteen-mile trip showed that the dithering or dancing under empty conditions had stopped. Evidently the " periods " of the two sets of springs being different, any tendency for vibrations on the outer main springs was checked by the auxiliaries. For the overload test the writer employed ten of the heftiest navvies engaged on the new work at Murthwaite and Ravenglass The coach showed no signs of the bumping previously experienced. No doubt Mr. Mitchell will see his way clear to fit all the troublesome roaches with the additional springs. The " bumping " is unpleasant, while the " dancing " might at any time cause a derailment, although the chances of continued synchronisation of the periods of the springs and those of the inequalities in the track which set up such vibrations are somewhat remote.

In designing a spiral spring two calculations are necessary (1) to ascertain whether the spring is not over-stressed, and (2) to determine the size of the spring required to produce a given deflection under a given load.

The writer usually roughly estimates a suitable size, then he calculates its defection, altering proportions until the required amount of compression (or extension) is obtained. Finally it is checked for safe stress. If the given toad overstresses the spring then the wire must be increased in diameter, and to adjust the deflection to the desired amount, the diameter and the number of the coils will have to be increased. A set of curves for both functions are given in the writer's book, "Model Steam Locomotives," are identical with those reproduced herewith. These curves are applicable to the smaller sizes used by model railway builders.

The following formulæ may be used where the curves cannot be applied.

---

*The vehicles are four-wheelers.

FORMULÆ FOR SPRING CALCULATIONS.

$$\delta = \frac{8\ L\ N\ D^3}{M\ d^4}$$

$$SL = \frac{\pi\ d^2\ f}{S\ D}$$

where δ = Deflection in inches.
f = Safe stress of material.
L = Load in pounds.
SL = Safe load in pounds.
M = Modulus of elasticity.
D = Mean diameter of spring in inches.
d = Diameter of wire in inches.
N = Number of coils in spring.

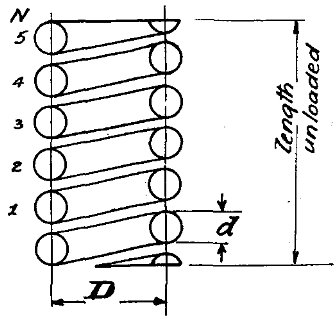


Fig. 6.

Mr. Wilson Hartnell gives a value far f of 70,000 to 60,000 lbs. per sq. in. for wires under $\frac{3}{8}$ in., and 50,000 for wires of $\frac{1}{2}$ in. diameter. Also a modulus (M) of 13,000,000 for $\frac{1}{4}$-in. wire and 11,000,000 for $\frac{3}{8}$-in. diameter wire.

For small wires these formula may be simplified as :—

$$\delta \text{ per 100 lbs. load and 10 coils} = \frac{D^3}{1626\ d^4}$$

$$SL = \frac{d^2\ 27{,}500}{D}$$

It will be noticed, in obtaining a suitable deflection, that the wire varies the amount of compression or extension inversely as the fourth power of its diameter, while with the diameter of the spring a cube law is to be observed. The load and number of coils vary the deflection directly ; therefore half the load, or half the number of coils, means that exactly half the deflection will be observed, in each case.

The safe toad may be increased inversely to the mean diameter of the spring, while altering the diameter of the wire, increases or decreases the safe load as the square of the respective diameters. To make the formula more useful a table may be prepared for office or workshop use, in which all the gauges of wires likely to be used are tabulated in their squared, cubed, and fourth power dimensions, the simplified formula can then be more easily handled, as it is often neces-

sary to try various combinations of diameters before a satisfactory result is obtained.

Where no drawing is sent care should be exercised in ordering springs. Manufacturers must know either the mean, inside or outside diameter (preferably the latter, except where springs work on a spindle), the length unloaded. number of complete coils, the size and shape of the wire or the diameter or gauge of wire if round, whether the spring is for compression or tension, and, finally, the requisite finish and shape.

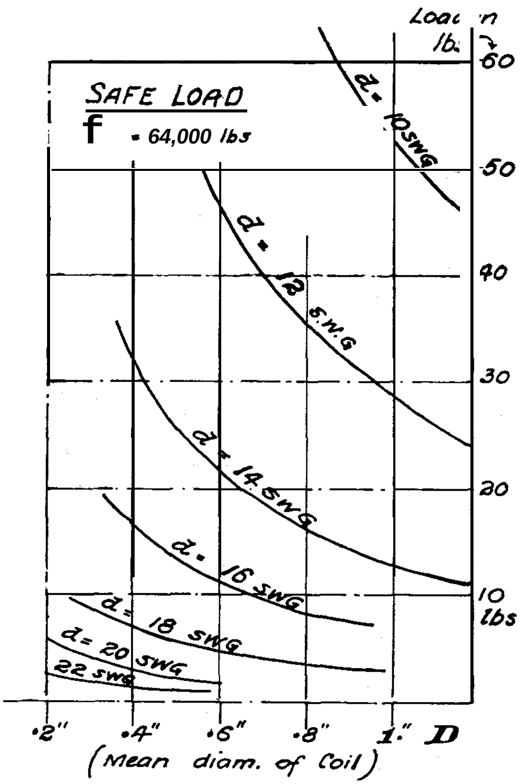


Fig. 5.—Safe Load Curves for Small Spiral Springs.

For the ordinary cylindrical compression spring with flat ends the order would read as follows:—

"4 springs off, compression, R.H. coils, $4\frac{1}{4}$ ins. long unloaded, No. 10 gauge round wire, $1\frac{1}{8}$ ins. outside diameter, cylindrical form, ends ground square, japanned."

In any case, don't forget that the springs will be received in their " unloaded " length, and that their position in a vehicle will be represented by their unloaded length minus the amount of deflection under the tare load. In arranging the coils sufficient space between them is necessary to provide for the maximum deflection.

Workshop Topics.

The principal items appearing under this heading relate to work done and other matters dealt with in THE MODEL ENGINEER *Workshop at 66, Farringdon Street, London, E.C.4.*

A Six-point Turret for Use on a Lathe Boring Table.

THE accompanying photograph (Fig. 1) shows a six-point turret, which has been made by a student of THE MODEL ENGINEER Workshop. So far as the "workshop" is concerned, however, in addition to advice given under instruction, the only work carried out was the turning and boring of the main casting and making the cutters, the actual setting-out, drilling for, fitting, and making the various shanks was all carried out by the student upon the lathe intended to take the accessory, and this was at his own home. Perhaps the most interesting

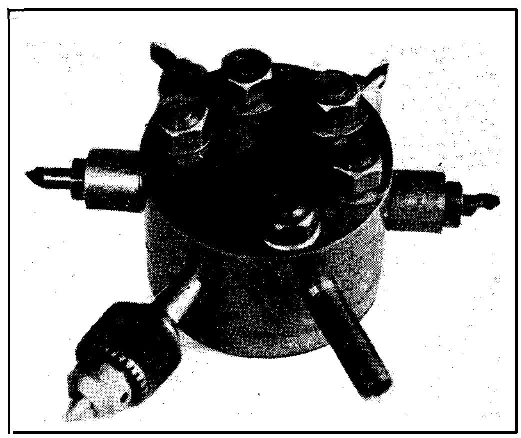
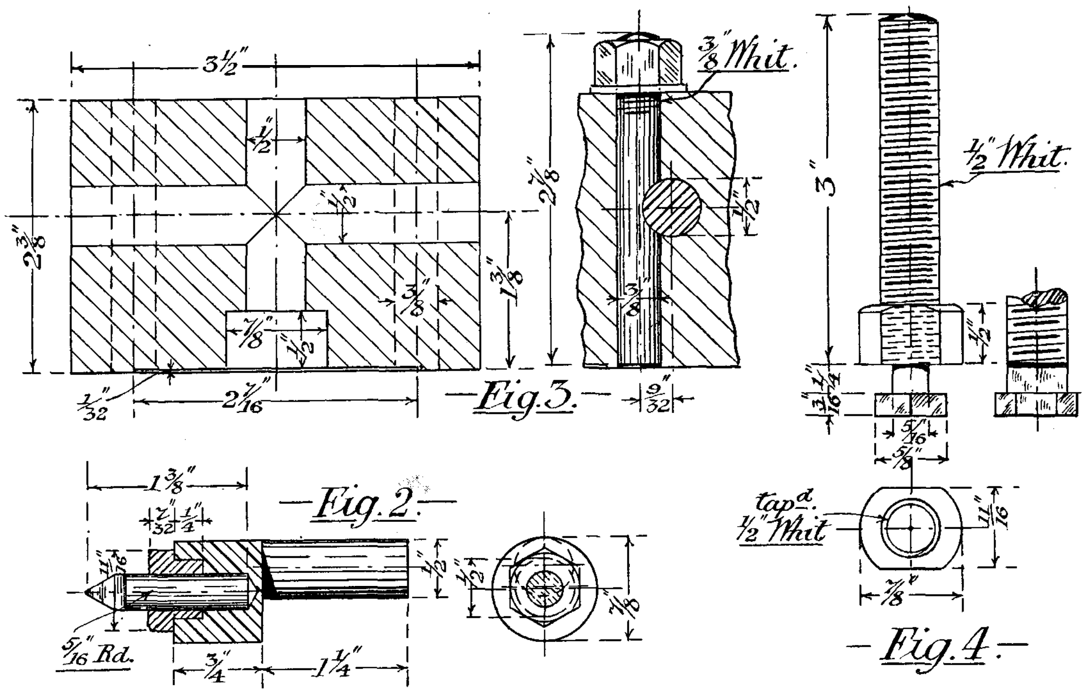


Fig. 1.—Six-point Turret for Use on a Boring Table.

point is the construction of the clamping arrangement on each shank, which carries the cutters. This was originated by the student himself, and forms the subject matter of a " complete " patent application under his name ; but it seems doubtful—a doubt shared by the would-be patentee—that it could be upheld, the idea having very closely been patented before. Having been, at any rate, published prior to this date, there will be no harm done in describing it. Fig. 2 (a drawing) shows the idea as carried out on this fitment. The $\frac{1}{2}$-in. shank, which is made $1\frac{1}{4}$ ins. long, is turned eccentric, flush with one side of the $\frac{7}{8}$-in. diameter head. There is nothing particularly new in this, however, the same idea being used on many American lathes for the purpose of adjusting round cutters to centre height. The shank is held, in any position it is put, in a similar size hole in the turret, and, by taking advantage of the crank-pin movement of the tool relatively to the shank and

setting, the former upright in its own clamp, it can be adjusted within its limits of throw to any height. It is the clamp of the tool itself which is the novelty, and this is shown in the section of the $\frac{7}{8}$-in. head to the left and front view of the same to the right. The head is recessed $\frac{1}{2}$ in. diameter by $\frac{1}{4}$ in. deep at a centre distance of about 1-64th in. out of centre with the head. To this is fitted, a nice push-in fit, a solid steel gland piece, which has a hexagon head. This is either clamped in tightly, or temporarily sweated into the head, to be drilled to take the round cutters. Then drilling is done concentric with the head, and, therefore, about always oversize for turning, and was machined all over. The first operation was to chuck it truly, base face outward, and running true by chalk to the outside. The body was then turned to $3\frac{1}{2}$ ins. diameter up to the jaws, and the base cleaned up to a flat surface. Next, the centre was cut out by a graver, and the block drilled through, centrally, $\frac{1}{2}$ in. cleaving. The inset face, 1-32nd in. deep and 27-16th ins. diameter, was then turned, by means of an end-facing boring tool, faced from the centre outward, and with the same tool the $\frac{7}{8}$-in. by $\frac{1}{2}$-in. deep recess was bored out. The job was then reversed in the chuck (an independent four-jaw), with the



Details of Six-point Turret and its **Toolholder.**

1-64th in. eccentric with the gland, and is holed to take the 5-16th-in. cutters a push-in fit. When the gland is set free it is only necessary to give it about a quarter turn either way, by means of a spanner, and it grips the tool so effectively that even cranked side-cutting tools will not move. It is essential, of course, that the direction of tightening should coincide with the direction of turning movement on the tool (if any), so that any tendency to turn tends to tighten it rather than the reverse

Fig. 3 shows the proportions and details of the turret, which was designed for use on a 9-in. round-bed lathe and upon the upper, or cross slide, boring table of the same. It was made from a solid cylindrical block of cast iron, base set right up to the jaw faces and the turned portion outside set running dead true. In this setting the outside was turned to match the remainder, and the top surface faced off. Upon the latter face a ring, 27-16th ins. diameter, was engraved upon which to set out the clamping-stud centres. If we now look at the photograph, we see there are only five clamping-nuts at the top. This is because the sixth point was arranged to take No. 1 Morse taper shank, which, in the picture, is shown mounting a small drill chuck with that form, of shank. The remaining five are drilled to take $\frac{1}{2}$-in. parallel shanks in the manner shown in Fig. 3, which drill is at such height above the base to bring their centres level with the lathe centre.

The method of clamping the parallel shanks is seen in the right-hand sectional elevation of Fig. 3, wherein the sectional line is on a plane level with the stud, and tangent to the radial centre of the ½-in. shank. As see", the sliding stud is a #-in. plain round piece in a vertical hole, threaded at top and fitted with a nut and washer ; in fact, a headless ⅜-in. bolt. This hole stands at a centre distance of 9-32nd in. from the shank centre. The setting out is as follows : The radius of the 27-16th-in. circle is stepped out six times round the marking off, and five of these points are dotted out for drilling. At 9-32nd in. distance from these points marks are made on the circle, all the same way about, and through these marks radial lines are scribed, and continued square with the top and down the sides of the 'turned cvlinde:. These locate the vertical position on the periphery of all six of the horizontal holes. The five stud holes acre then drilled through the block by means of a ⅜-in. drill. The job was stood upon its boring table, and the height for the horizontal holes marked off against a steel centre in either head of the lathe, and dotted out deeply for drilling. The studs were made from ⅜-in. bolts and nuts, but, as we have not the exact procedure carried out in this case, we will point out two ways of drilling the horizontal holes. As will be noted, the drilling of the horizontal holes, in the case of the five parallel ones, cuts a clearance partially through its accompanying stud, and, therefore, the studs must be firmly in position during the drilling, which was carried out with the accessory bolted to its table. One way is, keeping the ⅜-in. bolts in their original form, to nut them tightly down in their holes with the heads at the bottom, and then to set the job up upon a lower boring table, allowing for the bolt heads raising the job. Another is to mount the turret without the stud bolts on its own table, and start the five holes, not going deep enough to reach the studs, and then to set up as above to finish the drilling with the bolts in. The setting in these cases would, of course, have to be carried out to bring the setting out for the drilled holes level with the centre. It is not desperately important, however, that the shank holes should be exactly level with the centre, except in the case of those which take boring or drilling tools. How the writer would propose to do the iob is to cut off the stud bolt heads so that the stud was a little tong, and to upset the points. That is, make the point suitably hot for a short way down, and bulge it by hammering end on (hot end upward for preference). Then, by careful fitting, ta so reduce the end in diameter that when pulled into position by the nut and washer, with the point flush, or slightly under flush, nith the base, the stud is quite firmly held in the hole. By this means all the drilling can be done with the turret in its normal positioa, but the studs must be quite firmly held or a broken drill is likely to result. After the drilling the nuts and washers are removed, the studs driven out and reduced to a nice sliding fit foe use as clamps. A modification of this idea. but one which wants very careful drilling, is to use, in the first place, a" -undersize drill for the stud holes. The next size smaller than ⅜ in. is 9½ millimetres, which is only .001 in. less than size. If this drill were very carefully ground it would, no doubt, give a hole in which a ⅜-in. bolt would bind. and, therefore, obviate the upsetting process. I" this case the vertical holes, after the horizontal drilling, would have to be opened out by means of a ⅜-in. reamer. The use of the next size drill (letter U) would give a hole seven "thou" undersize, and either the ⅜-in. bolts would have to be reduced, or " fake " drilling adopted. By " fake " drilling is meant the drill would have to be ground slightly eccentric to give a hole a little over size, but it is doubtful whether this oversize would be upheld right through such a long hole.

As to the drilling of the Morse taper hole, this can be done without any reference to the clamps, the first hole being ⅜ in. right 'through. All holes, by the way, are carried to the centre. After the first hole the taper can be roughed out by step drilling (see a paragraph in this column on " Step-drilling a Tape-," on page 557 of Vol. XLVI). The hole is then finished by means of a No. 1 Morse taper reamer, held in a chuck, the job throughout the whole operation being mounted by its centre stud in its normal position.

A detail of the centre stud is given in Fig. 4. This is made from a ½-in. steel bolt, at least 3¼ ins. long, under the head. 'The thread of this is carried down to a dead end about ¼ in., or a little less, from the shoulder of the head. To this a nut is fitted, so that its flat face, when screwed to the tie end of thread, stands not more than 1 in. from the head shoulder. This nut id turned to ⅞ in. diameter, or a little less, that it mar enter clearly the hollowed recess in base of turret. It is flattened to 11-16ths in. width, in order to use a spanner on it. The hexagon head of bolt is reduced by chuck turning to 3-16th in. thick, and the hexagon filed to ⅝ in. across the flats. Parallel with a pair of its head flats, the bolt shank is evenly reduced by filing flats to 5-16th in. a-ide. and for a ¼ in. above the head shoulder. This: then, will go a sliding fit into the T-slots of the particular lathe employed, the nut acting as a foot. In actual practice, however, this nut is arranged to screw down and hold the stud firmly at a fixed position in the slot, the turret then never varies its centre position, as it might do when the top nut is loosened to turn the turret and this lower nut were not fitted.

Finally, we may point out that certain of the cutters had to be made angled. This is for the purpose of allowing such cutters to run up to the chuck jaws without the neighbouring tool to the left of it fouling the chuck body. In the photograph (Fig. 1) the two tools affected are the parting tool to the extreme right and the one behind it, which is an angled screw-cutting tool. The latter is so ground that, when it is set by the centre gauge square nith the turned work, the shank stands nearly to 45 degrees out of square with the lathe bed. By this means the next tool towards the chuck stands parallel about with the lathe centres and clears the chuck body. The parting tool is similarly made, being filed up first to the left side, after being flattened out a little when hot. When it was finished it was, of course, straight, but, before hardening, it was made hot and set a little to the right, so that it approaches the work in the straight position with its shank angled as above described, and the similarly angled screw-cutting tool also clears the chuck.

We may point out that the drill chuck shown is not its regular fitment, the actual drill chuck used being of the &dell-Pratt pattern on a ½-in. parallel shank, which shank is seen to the right front in Fig. 1. We are told that this tool is constantly in use producing work on repetition lines with accuracy and despatch.

As an after-thought we may point out that the ⅜-in. sliding studs were actually long bolts with heads fitted to the slots of boring table, and being bolted down tightly were held rigid during the drilling of the horizontal shank holes.

The turret is drilled with six pin holes, equally spaced on underside, so that, upon a single pin set in boring table, it may be on occasion used to locate all six settings accurately.

INVESTIGATION into the causes of the burning of firebars has shown that it is of great importance that only a very pure quality of cast-iron should be used for this part of a boiler furnace. Ordinary foundry iron, commonly used for firebars, contains phosphorous and sulphur, which when heated in the furnace change to compounds whose melting point is nearly 300 degrees lower than that of pure cast-iron. Consequently these impurities melt and run out, leaving a porous mass which is very rapidly oxidised at furnace temperatures. As a result of study of these phenomena, firebars cast of a specially pure iron have recently bean put upon the market, which are claimed to have from three to ten times the life of the ordinary commercial type.

J. H. H. (Swindon).—Thanks for your letter and suggestion *re* handbook. We will bear it in mind.

Model Marine Notes.

Vane Steering for Models : Sail and Power.

By H. HAMBLEY TREGONING.

BEFORE giving details of the construction of this apparatus at its present interesting stage of development, a model fitted with which was shown at the MODEL ENGINEER Exhibition of January, 1923, it will be as well to outline the essential principles of this departure from the generally accepted methods of steering models, and then to state briefly the case for

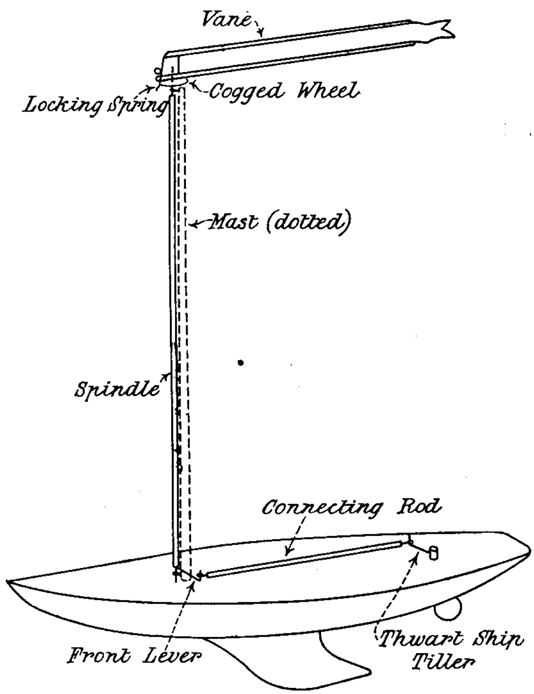


Fig. 1.—General Arrangement of the Vane Steering Mechanism fitted to Boat.

its adoption, based on evidence derived from the experiments which have been made up to the time of writing these notes.

Theoretically, the idea is both simple and scientifically sound. It is to harness the rudder of a model to an adjustable vane at the masthead in such a way that the vane will turn the rudder, when forced itself to turn by the wind, the reverse way to that in which the vane rotates. This vane, or stiffened flag, must be capable of being secured at will at such an angle to the boat's course that it blows out directly before the wind when the boat is proceeding on her course with the helm amidships. While in this position it exerts no power; but,

immediately the boat swerves, bringing a current of wind to bear on one side or the other of the vane, the fatter will tend to resume its original position with regard to the wind, and, in doing this, brings the rudder round in such a way that the boat is steered back to its proper course ; where the vane resumes its original angle to the boat's course, and the rudder is steadied.

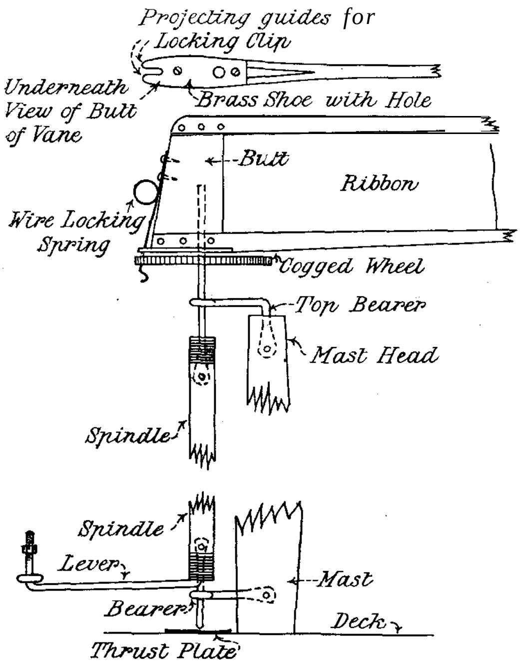


Fig. 2.—Details of Vane Steering Mechanism.

It may be asked by those familiar with the wonderfully accurate steering that can be accomplished with the gears (or rather gear, for there is only one worth considering—the Braine), what particular advantages has this new gear, unfamiliar to them in principle and practice, over others? I will try to state the case for it as fairly and moderately as I can.

Firstly, it is equally efficient in correcting deviations on all points of sailing. This is a unique claim to make for a model steering gear, but fully justified in this case. Every other gear has to be thrown out of action when it comes to real close-hauled sailing, but the model exhibited in January was pinched up to a course considerably closer than the usual four points off the wind a few days ago, and held a steady course at an angle which would, in the great majority of cases, have meant shivering in irons most of the time. I am far from asserting that the power to accomplish such a feat is of great practical use in model racing, but conditions will suggest themselves to experienced men when it would be very useful indeed. Then, with this means of control, a designer may begin to take liberties with his centres of effort, knowing that he can control lee helm as well as weather. An important point in connection with this complete control is that a single-sailed model can be sailed satisfactorily. There is little doubt that such a rig is advantageous to windward. It may be laid down as a certainty, in the case of a manned boat, that the smaller the boat the more advantageous is the undivided sail-plan. If this rule holds in the case of models—and I see no reason why it should not-vane steering is indeed worthy the attention of the model yacht designer.

Secondly, the vane is equally efficient, equally delicate and equally powerful in correcting deflections on either side of the correct course, in any direction, and under all circumstances. There can be no such thing as over-correction, and under-correction is only possible when too small a vane is used. The delicate operations of altering the tension of rubber cords, lengthening and shortening levers and sheets, involving endless experiments and occasionally a bad mistake, are all done away with, and the whole question fines down to judging correctly the direction of the wind in relation to the boat's course, and handling the sheets properly. The vane's action is governed by the direction of the wind. If the boat swerves slightly, the helm given to correct it is slight and gentle. With front lever and tiller of equal length (Fig. 1), the correcting angle taken by the rudder should be about equal to the angle of the boat's deviation from her course.

Thirdly, this gear is capable of being used to steer a power model at any time when a breeze is blowing on the course, unless, with a following wind, the boat is as fast, or faster, than the wind. I know little of power models practically, but it is a scientific fact that all boats in motion tend to turn head to wind. The use of this gear will prevent this, and a strong and steady breeze will be as good as a man at the helm. It must be borne in mind, however, than the vane must be set for the apparent breeze, which, in the case of a fast model, blows apparently from more ahead than the true breeze as felt by a stationary object.

This, briefly outlined, is the case for vane steering. Experiments have been made, not only with the 18-footer exhibited at the Horticultural Hall, which was specially selected as a hard boat to steer, but with a model 10-rater built to the well-known lines of Mr. Daniell's *XPDNC*. This beautifully balanced model gave excellent results at the first trial, sailing long distances-about half a mile-on a large sheet of water in practically straight lines in any required direction, except; of course, the

45 degrees, more or less, on either side of the wind's eye, which is closed to direct progress by any sailing craft. The vane gave results of equal merit on all these courses.

I will close by giving such details of construction as will enable anyone to fit this gear to any sailing or power craft where the masthead rises approximately clear of other spars. The reader must bear in mind that all parts are simplified to suit the use of limited tools and materials by an amateur workman. But anyone who follows the same methods will find the results strong, light and efficient. They have also the merit of being inexpensive.

First the vane itself. This I make long and narrow, 18 in. to 20 in. by 2 in. Vice-Admiral Bauduin, of the Royal Dutch Navy, who has been experimenting independently with a similar gear for some years, uses a short, almost square vane, which he finds efficient and satisfactory. But I have retained the long one, after due consideration, for the sake of the presumably greater sensitiveness to small changes of direction, and, therefore, probably finer steering. The framework is of three pieces of pine, shaped, when joined, like a hair-pin (Fig. 1). Top and bottom pieces are about 3-16th in. square, 'tapered to 3-32nd in. at the ends. The

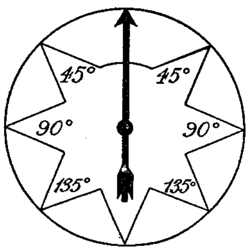


Fig. 3.—The Cogged Wheel Lettered and Painted.

butt (Fig. 2) is about 3-16th in. by $\frac{3}{4}$ in. I generally saw the top and bottom frames open at the butt (see Fig. 2), and insert the upright portion in the opening. The three parts are then secured by glueing and pinning ($\frac{3}{8}$-in. copper pins). This frame has a piece of silk ribbon (colour to taste) laced into it with cotton or thread. This is finished off with a free inch or two. The butt of the vane is now shod with a brass plate (Fig. 2), which projects level with the cogs of the wheel below, and has a slot sawn into it as a guide for the wire locking spring (Fig. 2). Into the plate and emtending up into the butt of the vane is now drilled a hole to receive the top end of the steering spindle, which is the centre of the vane's rotation, when the adjustment is being made, by dropping the wire locking spring into a cog of the toothed wheel below.

The spindle above mentioned forms the first stage of the vane's connection with the rudder. This may be placed inside the mast, if hollow; or, if the mast is solid, the spindle revolves on two bearers projecting obliquely forward from the mast at top and bottom to avoid touching fore-stay (Figs. 1 and 2). The spindle itself may be made of wood, wire, or metal tube. Mine is of wood, with top and bottom ends of brass wire, but this was merely a matter of convenience and ease of construction with available tools and materials. The wires are flattened at their ends and driven into the ends of the wooden rod, which has first been whipped with stout thread. If considered necessary, a small hole may be drilled through flattened wire and wooden spindle, and the whole riveted together with a brass or copper nail. The lower piece of wire is tapered to a point, which may rest on a brass thrust-plate on the deck. This bears the weight of the whole fitment and gives the minimum of friction.

Just clear above the mast-head, on the wire portion of the spindle, is now soldered a brass cogged wheel (Fig. 2) of 32, 40, 48, 56, or 64 teeth. Sixty-four is the ideal number, as it makes half-point ($5\frac{5}{8}$ degrees) differences possible in the adjustment of the vane. The vane can now be pushed down on the projection (Fig. 2, dotted), and locked between any two cogs at will by means of the brass wire locking spring, as above described. Fig. 3 gives a method of paintiag and numbering the top of the cogged wheel, painting the port side red and the starboard green. The arrow shows the boat's direction with the helm amidships. It is important to note that star points and arrow points must end in slots, not cogs.

At the bottom of the spindle, near the deck, a wire rod projects, horizontally, about three inches, fitted as shown (Fig. 2), with a shoulder and nut. I improvised this portion of the gear with a cycle spoke nipple sawn in two, the head forming the shoulder and the rest the nut. Its proper position is at right angles, or thereabouts, to the boat's length (Fig. 1) Between the shoulder and nut is fitted the end of the connecting rod (Fig. 1).

The rudder, if not already fitted aith the ordinary yoke or quadrant, when it is only necessary to pivot the rod to the extreme hole in yoke on the opposite side of the boat from that on which the spindle lever projects, has to be fitted with a thwart-ship 'tiller, which is an exact replica of the spindle lever, but fastened to the rudder stem on the opposite side from the spindle lever, as above.

The connecting rod itself may be made of wire, metal tube, or of wood and wire, in the same way as the upright steering spindle. This is fitted over the projecting portions of lever and tiller, and the nuts screwed on. In the case of a yoke being already fitted, it is pivoted into it by means of the usual bayonet-shaped hook, just like those on the already existing steering sheets.

The vane is now connected with the rudder in the manner already specified in the beginning of this article. I have already said so much about the very simple methods of using it that it is unnecessary to repeat

Workshop Notes and Notions.

Short practical notes of workshop interest are invited for this column. Contributions must be based on the sender's own experience, and should be marked "WORKSHOP NOTES" on the envelope. Accepted items are paid for within a few days. Unaccepted notes will be returned if a stamped addressed envelope be enclosed.]

Split Lugs.

The sketches below show a method of securing a split-lug to a shaft other than the screw principal. The lug is secured to the shaft by means of a taper key B passing through the contracting pin C, and bearing against the bracket A. An advantage by the method described is

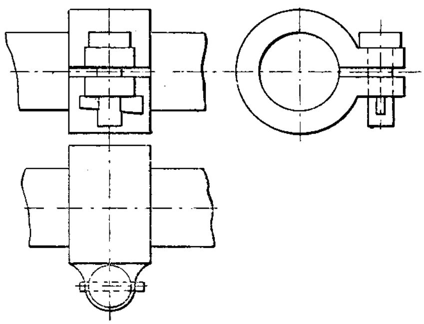
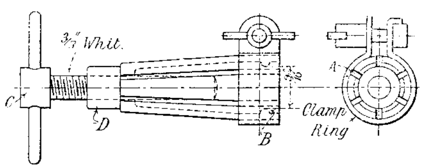


Diagram showing Method of Securing a Split Lug to a Shaft.

that the lower bracket A can be considerably less in thickness, as compared by the screw principal where there must be an increase of metal for the thread, thus diminishing the contracting power of the lug, apart from the danger of stripping the thread.

Magneto Ball Race Extractor.

Seeing the enquiry for a magneto ball race drawing tool in a recent issue, prompts me to give the drawing herewith of such a



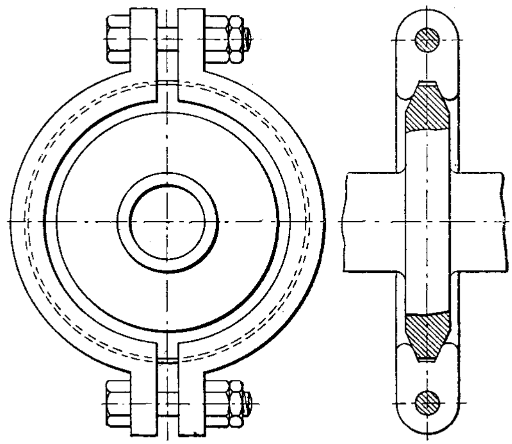
Front and Side Elevations of Magneto Ball Race Extractor.

fitting. This has done long and faithful service in a workshop where magneto repairs are specialised in. It consists of three parts, namely, body D, which is slit longitudinally three-quarters of length by 6 slits A, which allows for contraction and expansion when attaching fitting to ball race, and has an internal projection B, which fits into groove of ball race. Dar-wing screw C, by pressing on end of armature spindle, removes race. Clamp ring holds the projection B firmly in race groove during the drawing process.

It is the outcome of much experimenting to produce a permanent tool, and will be found a great asset to any garage.—E. C. DEARMAN (Wellington, N.Z.).

Pipe Couplings.

The ends of the pipes to be coupled together are fitted in any known manner with flanges. The back of each flange has a bevelled surface, such surface forming a frustum of the surface of a cone co-axial with the flanges. A strap



End and Sectional Side Elevations of Pipe Joint

having similar bevelled surfaces is clamped round the periphery of the pair of flanges so that its bevelled surfaces are in contact with the bevelled surfaces on the back of the flanges. The radial pressure between the bevelled surfaces on the strap and the bevelled surfaces on the flanges when the strap is tensioned, causes the flanges to be pressed together, and thus a tight joint is made between the faces of the flanges.

By the method described and illustrated the flanges may be considerably less in diameter, and coupled together with rapidity.

Turning Eccentrics.

When an eccentric and shaft are machined from solid bar, or the former is shrunk, keyed or secured in any form whatever to the shaft, the final machining of the eccentric may be completed between the lathe centres. If the eccentricity be too great for the centre to fall

upon the shaft, the difficulty may be overcome by leaving the shaft sufficiently long enough to form a screw to carry a nut which is of a suitable diameter to carry a centre opposite to that of the eccentric.

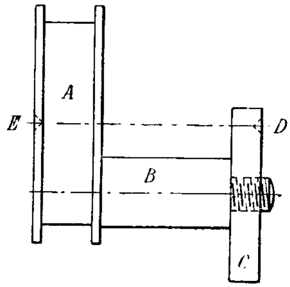


Diagram showing Method of Mounting Eccentric for Turning.

The above sketch shows an eccentric A and shaft B, which carries a nut C for the dead centres D and E of the eccentric A.

Radio Engineering.

By V. W. DELVES-BROUGHTON.

A Radio Puzzle: Explanation Wanted.

When visiting a friend's house one evening he was showing me his three-valve B.B.C. wireless set and a frame aerial that he had made for it. In the hurry of connecting-up he joined the ends of two windings on the frame to the aerial terminal on the set, leaving the other ends free. There were four turns on one winding and two on the other. The earth terminal remained connected to earth.

The above explains the connections. Now for the weird results.

First, the signals were stronger than when the frame aerial was connected properly. Secondly, there was no appreciable directive effect left in the frame, and, lastly, when anyone in the room touched the lead-in from the overhead aerial, signals were intensified to nearly the same strength as if the aerials were connected to the receiving set.

This touching the aerial could not have caused any direct connection by leakage, as it did not matter if the person holding the aerial wire was close to the instrument or far away or whether he had the 'phones on his ears or was entirely disconnected. Neither did it seem to be a capacity effect, as approaching the frame aerial did not increase the effect.

Another point in connection with this hitch-up is that although it is practically impossible to make the valves howl with the usual connections they started howling with the slightest provocation when connected as shown in the sketch below.

The size of the frame aerial is one metre on each side with a total of 16 turns, the first tapping being 4 turns with 6 tappings of 2 turns each, so arranged that only the turns in use are connected. No other combination of turns gave such good results as the combination sketched.

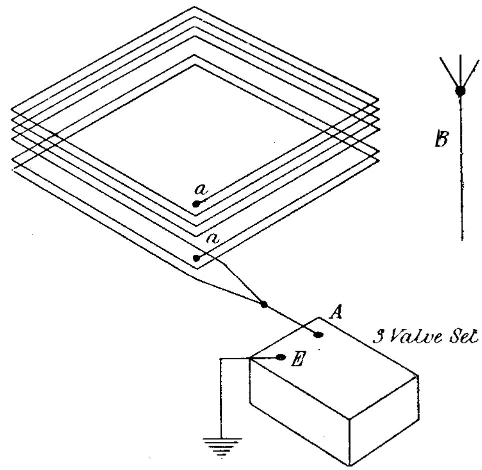


Diagram of Freak Connections.

a and a.—Free Ends of Coils on hams Aerial.
B.-Overhead Aerial Disconnected.
A.-Aerial Terminal on Receiver.
E.-Earth Terminal Connected.

As far as my experience goes no signals should have been received but we heard Beethoven's Sonata played at 2LO perfectly and should have heard more if we had not been trying other unlikely connections, which rather spoilt the music. So far we have only tried this on 2LO 369 metres wave-length.

* * *

Replies to Wireless Inquiries.

F. K. (S. Farnborough).-It is very doubtful if the "Ducon" will be satisfactory in your case as the amount of wiring in your building is extremely small. When the "Ducon" is used from public supply mains the whole system of wiring in the area supplied by those mains acts as the "aerial."

C. J. (Mitcham).—(1) "Hertzite" works best with a copper or brass point. It is of little use connecting L.R. 'phones in series with the idea of bringing up the total resistance. Each pair of 'phones must be of the necessary resistance. See *M.E.* for August 3, 1922. (2) *You* do not state the width of the rotor and stator of your variometer. If you have room for it, put 48 turns of No. 26 or 28 s.c.c. on the stator and 96 turns of the same on the rotor. An article on a variometer crystal set will be appearing shortly.

S. J. W. (Wallington).-Your circuit would seem to be correct.

L. E. B. (East Molesey.—(1) About 1,500 metres. (2) Yes ; your supposition is correct. It is a contraction for, " I am now changing over."

H. D. C. (Hassall).—(1) For telephone transformer use a core $\frac{1}{2}$ in. diameter made up of 10-in. lengths of No. 22 iron wire. Make the winding space 3 ins. long, using a-in. diameter bobbins. Primary, $3\frac{1}{2}$ ozs. No. 42 S.S.C. wire ; secondary, $\frac{3}{4}$ oz. No. 38 S.S.C. wire. On completion, fold the projectings ends of the core wires over the windings and lash together firmly. (2) Telephone transformers function quite well in crystal circuits. (3) The main factor is the maximum amount of inductance required. (4) The connection is the usual form. + L.T. to left-hand leg of filament, — L.T. to rheostat, and rheostat to right-hand leg of filament.

Practical Letters from our Readers.

Painting Loco. Frames.

To THE EDITOR OF The ***Model Engineer.***

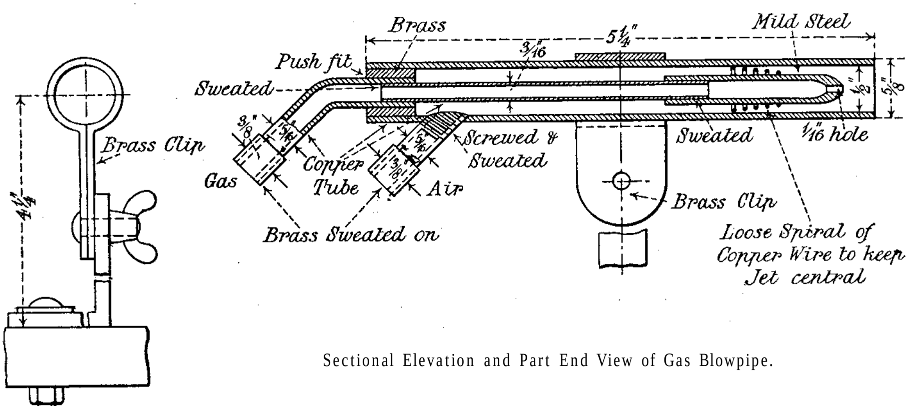
DEAR SIR,—Can you please inform me of the details of colouring of the Furness Railway locomotives, both outside and ***between the frames?*** I mention this last as I find some engines are left with merely a coat of red-lead paint between the frames, while others are finished with the main colour.—Yours faithfully,

STEPHEN OSBORNE.

Gas Blow Pipes.

To THE EDITOR OF ***The Model Engineer.***

SIR, - I give a rough sketch, to scale, of a gas blow-pipe which I have made, and which I find gives ample heat for small brazing. This may be of use to your correspondent, N. II.



Sectional Elevation and Part End View of Gas Blowpipe.

King, who wrote on the subject in January 11 issue last. It gives- a flame 8 ins. long, using $\frac{3}{8}$-in. gas supply. The whole of gas jet pulls out in one piece for cleaning, etc.-Yours, etc.,

H. K.

G. R. (Perth).---The circuit you show would not function. You require a leak across the grid condenser. Even then such a circuit will be no better than a ***good*** crystal set. Fig. 22 of " Wireless Circuits" would be very suitable if carefully adjusted.

A. W. hl. (Lee). If you will get the issue of ***Junior Mechanics*** for April, you will find exactly what you require and adapted to the actual inductance illustrated.

F. J. \I'. A. (Brockley) .—(1) You are hardly likely to get sufficient wire on one basket. Try two in series, each 4 ins. diameter wound with 40 turns of So. 24 S.C.C. enamelled wire. (2) Any of the usual crystal detectors will serve. (3) The most satisfactory method is to clamp them together by a screw passing through the centre of the card former.

S. H. (Devonport).-The compression space would be approximately one quarter the total cylinder volume. Power developed wili depend largely upon details of design and workmanship put into the job, but at 1,000 r.p.m. you would probably get $\frac{3}{4}$ b.h.p.

0 Gauge Railway Tyres

To THE EDITOR OF ***The Model Engineer***

DEAR SIR,—As a keen model railway man, especially in gauge 0, I should like to have some information about gauge o wheel tyre widths and dimensions. In the " Model Railway Handbook," the minimum wheel tyre width is given as 6.5 mm., which at a scale of 7 mm. to the foot is nearly equivalent to 1 foot real. This seems to me to be very thick. I think a lot of gauge o models are spoilt in appearance by the thick tyres. It also means that the superstructures have to be wide enough to accommodate them. Surely with the new improved small scale permanent way these tyre widths could be reduced.

I should be very glad to have any model o gauge railwayists views.—Yours faithfully,

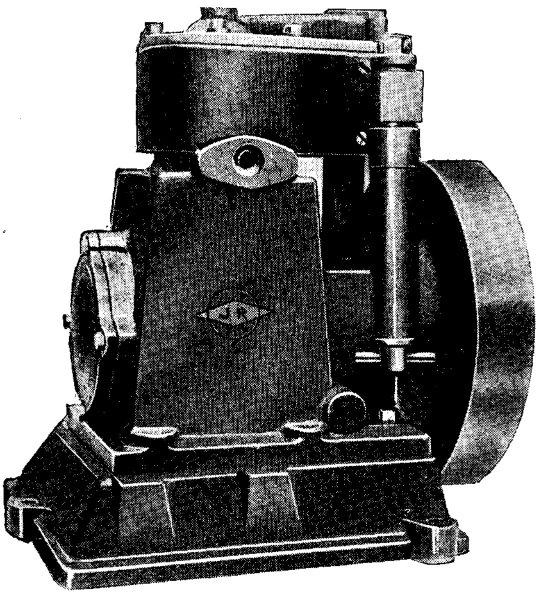
S. H. M.

News of the Trade.

Uniflow Model Steam Engines.

The "Don" uniflow engines, designed for model boats, already described in these pages, have since been produced in a commercial form by Messrs. Jackson-Rigby Engineering Co., Ltd. (the makers of the J R. Lathe), of Station Road, Shalford, near Guildford, Surrey. The sets of castings are now ready and among the improvements necessary to cut down the weight and to make it possible for the man with a small lathe to machine it, the out-of-solid crankshaft present in Mr. Don's experimental engine has been superseded by cast mild steel crankshaft complete with the cam rings formed on the centre web.

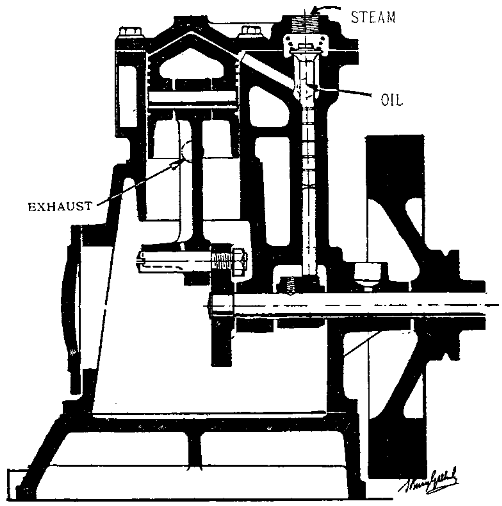
On test with a saturated steam boiler a 9-16ths-in. by $\frac{3}{4}$-in. engine (the D56) gave a speed of 4,100 revs. per minute in a trial of two hours' duration. It was also found that the engine would run as low as 60 revs. per minute and continue to function with the met steam supplied by a boiler after the fire had been withdrawn, down to a gauge pressure of 10 lbs.



The G1 Enclosed High-Speed Uniflow Engine.

per square in. No difference was observed in performance or in starting when the flywheel was removed, and had time permitted and the lubricator been large enough the engine would have apparently continued running indefinitely. From being a new departure alone, the uniflow system is well worthy of the model engineer's attention, but this claim is accentuated by the fact that the performances of the ordinary slide valve engine can be surpassed. The engines are eminently suitable for use with superheated flash boiler steam. There are no glands, and no non-ferrous wearing parts are subjected to high temperatures.

The G1 stationary engine is Mr. Henry Greenly's contribution to model uniflow steam engine design. He has realised for some time past that the model slide valve engine became



Sectional View of the G1 Engine.

an almost impossible proposition where direct dynamo driving is desired. Unless a speed of over 2,500 revs. per minute can be obtained, and maintained hour after hour, the dynamo must be belt-driven. A slow speed engine is not thermally efficient, and by adopting the cam-operated poppet valve and uniflow steam distribution a robust, economical engine is possible. On test the experimental I-in. by I-in. engine shown partly finished at the recent *M.E.* Exhibition attained a continuous speed of 3,400 revs. per minute and over 3,000 revs. under load. The balance, at such a high-speed always a difficult problem in a single-cylinder engine, has been perfected to a high degree. The crank is ofdthe balanced pattern, but as each engine may vary slightly the best balance is arranged to be finally obtained by the simple method of drilling holes of various depths in the rim or side of the flywheel. The first test engine ran with remarkable steadiness. By this method the most fastidious experimenter can be satisfied and meet the special needs of his case.

The engine has a very light cast-iron piston, steel valves, bronze connecting-rod, pins and shafts of bar steel ground truly cylindrical to a limit of accuracy of one-quarter-thousandth of an inch. The flywheel is no less that $3\frac{3}{4}$ ins. in diameter, which helps to steady the running.

The set of fine iron castings, drawings, materials, including ground bar shafts and screws, are sold for 10s. 6d. Faulty castings are replaced.

Society and Club Doings.

Secretaries are notified that all notices of **forthcoming meetings must** *reach us 10* ***days*** **previous to date of** ***publication*** **of any given issue.**

Model Engineering.

The Society of Model & Experimental Engineers.

A report of a demonstration given at the Workshop, by Mr. H. G. Eckert, on "Elementary Turning," one of the series on "The Elementary Use of Tools," will appear next week.

FORTHCOMING MEETINGS.—The next ordinary meeting will be held at Caxton Hall. Westminster, commencing at 7 o'clock, on Wednesday, April 11, Mr. L. G. M. Ferreira will try to inject a stimulant into the boilermen by giving tips and wrinkles on "Injectors." These often have a habit of not working when brought down to model size, and now we shall know how to make them do so. Then Mr. H. E. Taylor will talk "Fits," afterwards locomotive trials on the tracks will take place and provision will be made for steaming stationary engines, members having either of these which are in good order and warranted to go please bring them along ; anything in the model line that requires to be driven by steam will be welcome. On Wednesday, May 2, there will be another ordinary meeting for business nith a lecture, the subject to be announced later. On Thursday, May 31, Mr. J. Ii. Maskelyne, a member, will give a lecture on "The Sense of Proportion and its Rearing on Model Locomotives and their Work," and on Tuesday. June 26, the Presidential address will be delivered by Admiral Sir R. H. S. Bacon, K.C.B., K.C.V.O., D.S.O.

TREASURER.--Mr. A. J. R. Lamb, Room 173, Windsor House, Victoria Street, Westminster, S.W.1.

COMPETITIONS.—At each of the ordinary meetings there will be competitions for the Challenge Shield, Classes A, B and C, and for the Bronze Trophy. Don't forget to bring up work on Wednesday next.

WORKSHOP.—Rummage sales on Monday, April 9, and Monday. May 7, at 7 o'clock for 7.30, all entries to be made before the latter time. Be sure to come on Monday, the more there are present the better prospect for sellers, the more sellers are encouraged the better bargains for buyers. Will some of those members who have not been before turn up and join the fun ?

Full particulars of the Society with forms of application for membership and visitors' cards for the meetings at Caxton Hall and for Workshop, may be obtained from the Secretary, F. H. J. BUNT, 31, Mayfield Road, Gravesend, Kent.

The Bristol Society of Experimental Engineers and Craftsmen.

FORTHCOMING MEETINGS. — April 10. This will be the open night for models. Don't forget the previous injunctions *re* friends and models ; April 17, "Primitive Metal Working," by L. W. G. Malcolm. B.Sc. (Cantab.).

Hon. Secretary, HY. G. PRIEST, 278, Bath Road, Bristol.

Devonport and District S.M. & E.E.

The second meeting of the above society was held, with an increased attendance, at the Stoke Public Hall, Tavistock Road, Devonport, on March 21. After fixing the subscription to the society at 2s. 6d. a member per quarter, Mr. Langman gave a most interesting paper on "The Evolution of the Steam Engine." The history was (traced from earliest times to the time of Savery in 1700.

Several models, including a miniature oscillating engine by Mr. Langman, and two fine models by Mr. Watts were exhibited. There was also on view a model of an electrically-operated beam engine, reputed to have been made by Sir William Snow-Harris. The society welcomes recruits.

Particulars can be had from the Secretary, G. WARBURTON, 31, St. Aubyn Avenue, Keyham, Devonport.

British Horological Institution.

At the British Horological Institute, Northampton Square, Clerkenwell, E.C., on Thursday, April 19, at 7.45 p.m., Mr. F. Hope-Jones, M.I.E.E., will lecture on "The Free Pendulum." The lecture will be illustrated by drawings and working models. Tickets for admission to the lecture may be had on application to the Secretary.

Marine.

Portsmouth Model Steamboat Club.

The club members held races at the Canoe Lake, Southsea, on Saturday, March 24, for prizes presented by Messrs. J. 4. Walters and C. Chandier. The boats had to steam over two laps of the circular course equal to 205 yards, and, thanks to the light breeze and calm water, they were able to put up some good performances. In the metre boat event for Mr. Walters' prize Mr. Wareham's hydroplane Zu Zu ran extremely well, doing the distance in 41 1-5 seconds, equal to a speed of 10.1 miles per hour. It was interesting to see her running half-out of the water, especially so on the second lap when she started jumping over the waves she had made in the first one. *Molly* IV took

second prize, her time being 71 1-5 seconds, equal to 5.8 m.p.h. The prize for the $1\frac{1}{2}$-metre boats was won by Mr. Chapman's *Joyce*, a new flash steam hydroplane, her time being 46 3-5th seconds, equal to 9 m.p.h. Mr. Chandler's prize for the $1\frac{1}{2}$-metre boats was won by Mr. Walters' Rash steam hydroplane *Yokel*, time 60 2-5th seconds, equalling 6.9 m.p.h.; this is also a new model, and when tuned up should show a considerable increase in her speed. Joyce was also entered for the event, but owing to the filling plug of her blow-lamp breaking off short when being screwed up, she could not be got running properly, none of the other boats lamps being fierce enough. The times were taken by the official timekeeper, Mr. Chandler.

Hon. Secretary, W. E. CRAGO, 126, Orchard Road, Southsea.

Wireless.

North Middlesex Wireless Club.

(Affiliated with the Radio Society of Great Britain).

The annual general meeting of the above Club was held at Shaftesbury Hall, Bowes Park, N., on March 7.

A resumé of the doings of the Club for the past year was given by the various officers and the balance-sheet was presented and adopted.

The financial position is satisfactory and membership is now about 100.

Before the election of officers for the coming year was taken in hand, there was a pleasant interlude in the form of a presentation of a handsome marble clock to the retiring Secretary, Mr. E. M. Savage, given by the Club on the occasion of his marriage Mr Arthur, in making the presentation, referred in well chosen terms to the debt the North Middlesex Wireless Club owed to Mr. Savage for his untiring efforts in the interests of members since the Club was founded in 1914.

Mr. Savage briefly responded, expressing his regret that pressure of business prevented him from continuing to act as Secretary.

The election of officers and committee was then proceeded with, and resulted in the following gentlemen being declared elected:

President, Mr. A. G. Arthur; Vice-President. Mr. E. M. Savage; Hon. Secretary, Mr. H. A. Green; Installation Officer, Mr. RI. Symons; Treasurer, Mr. W. A Saville; Librarian, Mr. E. W. Cornford; Chairman, Mr. A. J. Dixon; Committee: Messrs. Chnpple, Gartland, Holton, Weare and Wordham.

Hon. Secretary, H. A. GREEN, 100, Pellatt Grove, Wood Green, N 22.

The Leeds & District Amateur Wireless Society.

An instructional meeting was held on March 9, when the Hon. Secretary, lectured on "How to receive WQK, MSK, SUE or 2LO on a Single-Valve Indoor Aerial Set." The receiver was fully described, and the results of experiments with such a set, that had been attained during the last two years put forward. A keen discussion followed which undoubtedly had the effect of disheartening the experimenter who had spent much money and valuable time erecting an elaborate aerial system to receive the above transmissions. The lecture was preceded with a short paper entitled "Oscillation and Radiation," in which the lecturer explained the vast difference between locally generated H.F. and L.F. alternating currents.

A party of members to the number of forty visited the Telegraph Department, G.P.O., Leeds, on Saturday, March 6, when, by the kindness of the Postmaster, the President, the Hon. Treasurer, and Mr. J. Walker were permitted to explain and show the elaborate and intricate mechanism of a large telegraph and relay office to a most enthusiastic audience.

Hon. Secretary, Mr. D. E. PETTIGREW, 37, Mexborough Avenue, Chapeltown Road, Leeds.

Notices.

The Editor invites correspondence and original contributions on all small power engineering, motor and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected, or not, and all MSS. should be accompanied by a stamped envelope addressed for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 66, Farringdon Street, London, E.C.4. Annual Subscription, £1 1s. Rd., post free to all parts of the world.

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Contents.

The asterisk (*) denotes that the subject is illustrated